

TABLE 3-continued

Enamel-Gold Alloy Shear Bond Strength (kgf/cm <sup>2</sup> ) in 2000-Time Thermal Cycle Tests; Barbituric Acid Type		
	Adhesive monomer in primer	Enamel-gold alloy shear bond strength (kgf/cm <sup>2</sup> ) (2000 cycles)
EXAMPLE 18	10-MDDT	317
COMPARATIVE	No primer	165
EXAMPLE 9		

## Notes:

Adhesive resins used: BPO-DEPT-barbituric resin system.

Gold alloy: "Supergold" (type 4) (made by "Shofu Inc.")

## EXAMPLE 19

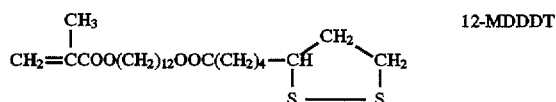
Powder and liquid adhesive resin cements incorporating compounds of the invention were prepared in the following way. For the powder resin cement, the powder cement of EXAMPLE 16 was used as such. The liquid resin cement was prepared by mixing a 1:2 (mol) reaction product of isophorone diisocyanate and 2-hydroxyethyl methacrylate (65 parts by weight), triethylene glycol dimethacrylate (24 parts by weight), ethyleneglycol dimethacrylate (10 parts by weight), 6-methacryloyl-oxyhexyl 6, 8-dithiooctanate (6-MHDT) (1.0 part by weight), benzoyl peroxide (0.5 part by weight) and butylated hydroxytoluene (0.05 part by weight).

When the powder and liquid adhesive resin cements were mixed and kneaded in a powder/liquid ratio of 3.5:1.0 (weight ratio), the resulting paste was hardened in 5 to 8 minutes at room temperature. An enamel-gold alloy bond was formed using the paste, and in the same way as in EXAMPLE 16 the shear strength of the bond was measured to give 287 kgf/cm<sup>2</sup>.

## EXAMPLE 20

Into a four-necked 500 ml flask were introduced 18.90 g (0.07 mol) of 12-hydroxydodecyl methacrylate synthesized from 1, 12-dodecamethylene glycol and methacrylic acid in substantially the same way as in EXAMPLE 3, 10.30 g (0.05 mol) of N, N'-dicyclohexylcarbodiimide, 10.36 g (0.05 mol) of thiostic acid and 100 g of benzene, which were dissolved therein, and the solution was continuously stirred at room temperature for two weeks. There developed a white precipitate. After completion of the reaction step, the precipitate was filtered. Subsequently, the step of separation and purification was carried out in the same manner as in EXAMPLE 1. Then the benzene was distilled away. Thus, an object compound in a yellow crystalline form was obtained in the amount of 7.55 g (yield: 23.5%). The compound had a melting point of 30.3 ° to 30.6° C.

Analyses of the compound, including <sup>1</sup>H-NMR spectral analysis, <sup>13</sup>C-NMR spectral analysis and mass spectral analysis, were carried out. As a result, the compound was identified as 12-methacryloyloxydodecyl 6, 8-dithiooctanate (referred to as 12-MDDDT) represented by the following formula.

<sup>1</sup>H-NMR spectrum:(ppm)

1.27	(16H—O—CH <sub>2</sub> CH <sub>2</sub> —(CH <sub>2</sub> ) <sub>8</sub> —CH <sub>2</sub> CH <sub>2</sub> —)
1.44	(4H—O—CH <sub>2</sub> CH <sub>2</sub> —(CH <sub>2</sub> ) <sub>8</sub> —CH <sub>2</sub> CH <sub>2</sub> —O—)
1.27, 1.65, 2.31, 3.14	(8H—OOC—13 (CH <sub>2</sub> ) <sub>4</sub> —CH<)
1.94	(3H—CH <sub>3</sub> )
1.65, 1.91, 2.46, 3.55	(5H>CH—CH <sub>2</sub> —CH <sub>2</sub> )
4.06, 4.13	(4H—O—CH <sub>2</sub> CH <sub>2</sub> —(CH <sub>2</sub> ) <sub>8</sub> —CH <sub>2</sub> CH <sub>2</sub> —O—)
5.54, 6.09	(2H CH <sub>2</sub> C<)

<sup>13</sup>C-NMR spectrum:(ppm)

18.2	(1C —CH <sub>3</sub> )
24.6, 28.6, 33.9, 34.4	(4C —OOC—(CH <sub>2</sub> ) <sub>4</sub> —)
38.3, 40.0, 56.2	(3C >CH—CH <sub>2</sub> —CH <sub>2</sub> —)
25.8, 28.4, 28.5, 28.6, 29.1, 29.3, 64.3, 64.6	(12C —O—(CH <sub>2</sub> ) <sub>12</sub> —O—)
124.9, 136.4	(2C CH <sub>2</sub> =C—)
167.3, 173.3	(2C —COO—(CH <sub>2</sub> ) <sub>12</sub> —OOC—)

MASS spectrum:molecular weight 458

Metal-metal tensile bond strength measurements were made using 12-methacryloyloxydodecyl 6, 8-dithiooctanate (12-MDDDT) in substantially the same way as in EXAMPLE 1. The results of the measurements are shown in Table 4.

TABLE 4

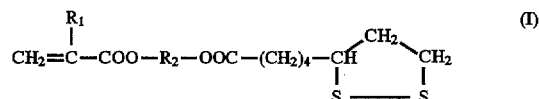
Precious Metal-Precious Metal Tensile Bond Strength (kgf/cm <sup>2</sup> )2,000-Time Thermal cycles: TBBO resin system	
Substrate metal	EXAMPLE 20 (12-MDDDT)
Gold	259
Silver	440
Platinum	488
Palladium	499
Gold alloy	505
Silver alloy	391
Gold/silver/palladium alloy	445

Novel adhesive compositions according to the present invention which incorporate a (meth)acrylic ester derivative containing a disulfide cyclic group exhibit strong adhesion and high bond durability relative to precious metals, such as gold, silver, platinum, palladium and alloys thereof.

Such (meth)acrylic ester derivatives and adhesives incorporating any such derivative are available for use as adhesives for precious metals in dental and medical application areas and, in addition, may be widely used as general industrial adhesives in general industrial fields including jewelry art.

What is claimed is:

1. A (meth)acrylic ester having a disulfide cyclic group represented by formula (I):



in which R<sub>1</sub> represents a hydrogen atom or methyl group, and R<sub>2</sub> represents a C<sub>3</sub>-C<sub>14</sub> alkylene group unsubstituted or substituted by a member selected from the group consisting of an unsaturated group, an alkyl group, and an alkylene group bonded with phenoxy group.

2. A (meth)acrylic ester of claim 1, in which the unsaturated group is a group of the formula: